

What is claimed is:

1. A conductive article of manufacture having its conductive component outermost comprising

a polymeric substrate,

a first layer of material of high refractive index deposited on the substrate,

a layer of material of low refractive index deposited on said first layer of material of high refractive index,

a second layer of material of high refractive index deposited on said layer of material of low refractive index, and

a layer of conductive material overlying said second layer of material of high refractive index, said conductive layer being outermost for direct electrical contact,

said material of high refractive index having an index of refraction equal to or greater than the index of refraction of said substrate, and said material of low refractive index having an index of refraction less than the index of refraction of said material of high refractive index,

said layers of materials of high and low refractive index being effective to substantially optically match the refractive indices of said layer of conductive material and said substrate and to minimize reflection of the article over the visible light spectrum.

2. A conductive article as set forth in Claim 1 wherein said layers of material of high refractive index comprise TiO_2 and said layer of material of low refractive index comprises SiO_2 .
3. A conductive article as set forth in Claim 2 wherein said layer of conductive material comprises a transparent conductive oxide.
4. A conductive article as set forth in Claim 3, where the article is adapted to be adhered at the surface of its conductive layer to a display or lamination medium.
5. A conductive article as set forth in Claim 4 wherein said layer of conductive oxide has a thickness of about 110 nm and a surface resistivity in the order of about 60 ohms per square, said first layer of material of high refractive index has a thickness in the order of about 15-16 nm, said layer of material of low refractive index has a thickness in the order of about 36-38 nm, and said second layer of material of high refractive index has a thickness of about 21-22 nm, and said article has a reflectance of less than 10% over a broad region of the visible light spectrum.
6. A conductive article as set forth in Claim 1 including a second layer of material of low refractive index deposited on said second layer of material of high refractive index and underlying said layer of conductive material.
7. A conductive article as set forth in Claim 6 wherein said layers of material of high refractive index comprise TiO_2 , said layers of material of low refractive index

comprise SiO_2 , and said layer of conductive material comprises a transparent conductive oxide.

8. A conductive article as set forth in Claim 7 wherein the article is adapted to be used with its conductive layer exposed to air.
9. A conductive article as set forth in Claim 8 wherein said layer of conductive oxide has a thickness of about 20 nm and a surface resistivity in the order of about 400 ohms per square, said first layer of material of high refractive index has a thickness in the order of about 26 nm, the first-named layer of material of low refractive index has a thickness in the order of about 19-20 nm, said second layer of material of high refractive index has a thickness in the order of about 61 nm, the second layer of material of low refractive index has a thickness in the order of about 61 nm, and said article has a reflectance of less than 10% over a broad region of the visible light spectrum.
10. A method of producing an electrically conductive article having its conductive component outermost and having reduced reflectance over a broad region of the visible light spectrum, comprising the steps of
 - providing a polymeric substrate,
 - depositing on the substrate a first layer of material of high refractive index,
 - depositing on the first layer of material of high refractive index a layer of material of low refractive index,

depositing on the layer of material of low refractive index a second layer of material of high refractive index, and

depositing on the second layer of material of high refractive index an outermost layer of a transparent conductive oxide,

the alternating layers of materials of high and low refractive index being effective to minimize reflectance and enhance transmittance of the article over a broad region of the visible light spectrum.

11. A method as set forth in Claim 10 wherein the alternating layers of materials of high and low refractive index are effective to provide a transparent conductive article having visible light reflectance of about 10% or less and visible light transmittance of about 90% or more.
12. A method as set forth in Claim 10 including the performance, after the step of depositing the second layer of material of high refractive index and before the step of depositing the layer of a transparent conductive oxide, of the step of depositing on the second layer of material of high refractive index a second layer of material of low refractive index.
13. A method as set forth in Claim 10 where the article is adapted to be adhered at its outermost conductive layer to a display or lamination medium and the method includes the steps of:

depositing a relatively thin first layer of the material of high refractive index,

depositing a relatively thick layer of the material of low refractive index,
depositing a relatively thin second layer of the material of high refractive
index,

and

depositing a much thicker layer of the transparent conductive oxide.

14. A method as set forth in Claim 10 wherein the article is adapted to be adhered at its outermost conductive layer to a display or lamination medium and the method includes the steps of:

depositing on the substrate a first layer of TiO_2 having a thickness in the order of about 15-16 nm,

depositing on the first layer of TiO_2 a layer of SiO_2 having a thickness in the order of about 36-38 nm,

depositing on the layer of SiO_2 a second layer of TiO_2 having a thickness in the order of about 21-22 nm, and

depositing on the second layer of TiO_2 a layer of indium oxide or tin oxide or a indium tin oxide having a thickness in the order of about 110 nm and a surface resistivity in the order of about 60 ohms per square.

15. A method as set forth in Claim 14 wherein the alternating layers of high and low refractive index are effective to provide a transparent conductive article having visible light reflectance of about 10% or less and visible light transmittance of about 90% or more.

16. A method as set forth in Claim 12 wherein the article is adapted to be used with its outermost conductive layer openly exposed and the method includes the steps of:

depositing a relatively thin first layer of the material of high refractive index,

depositing a relatively thin first layer of the material of low refractive index,

depositing a relatively thick second layer of the material of high refractive index,

depositing a relatively thick second layer of the material of low refractive index, and

depositing a relatively thin layer of the transparent conductive oxide.

17. A method as set forth in Claim 12 wherein the article is adapted to be used with its outermost conductive layer openly exposed, and the method includes the steps of:

depositing on the substrate a first layer of TiO_2 having a thickness in the order of about 26 nm,

depositing on the first layer of TiO_2 a first layer of SiO_2 having a thickness in the order of about 19-20 nm,

depositing on the first layer of SiO_2 a second layer of TiO_2 having a thickness in the order of about 61 nm,

depositing on the second layer of TiO_2 a second layer of SiO_2 having a thick ness in the order of about 61 nm, and

depositing on the second layer of SiO_2 a layer of indium oxide or tin oxide or indium tin oxide having a thickness in the order of about 20 nm and a surface resistivity in the order of about 400 ohms per square.

18. A method as set forth in Claim 17 wherein the alternating layers of materials of high and low refractive index are effective to provide a transparent conductive article having visible light reflectance of about 10% or less and visible light transmittance of about 90% or more.
19. A method as set forth in Claim 10 wherein the steps of depositing are performed sequentially by sputter deposition.
20. A method as set forth in Claim 19 wherein the steps of depositing are performed sequentially in a sputtering chamber having a plurality of sputtering stations.